From a Conventional Water Service Operation System to a Widely Integrated System

Hideaki Kuwada

Water Service Infrastructure Engineering Department, Waterworks System Division, Public Utility Services Center Co., Ltd., Shinjuku i-Land Tower, 37th floor, 6-5-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo, Japan (E-mail: kuwada@puc.co.jp)

Abstract
We propose an integrated computerized system supporting a wide range of water service operations. This widely integrated system for service operations can contribute to the maintenance and evolution of waterworks not only inside but also outside Japan, where each water utility organization in the nation has been promoting such important measures as service area expansion. As water is a common indispensable resource in all countries and regions, to continue supplying safe water stably and develop the waterworks, water service operations, which mainly consist of collecting charges, should be appropriately processed.
We can roughly classify water service operations into three categories: basic operations associated with collecting charges, operations incidental to the basic operations, and operations providing water service users with various kinds of information. Most waterworks utilities in Japan have already introduced conventional water service operation systems that support the basic operations. However, considering that the water service operations include various kinds of work, we can improve the conventional water service operation system itself and evolve it into a widely integrated system that supports the operations incidental to the basic service operations and other service operations so that the water service operations are done more accurately and more efficiently.

Keywords
call center; charge collecting system; comprehensive outsourcing; customer service; service area expansion; water service operation

INTRODUCTION

A general view of the current situation of the waterworks in Japan shows that each water utility organization has been promoting important measures, such as new investment in systematization, strategic outsourcing of service operations, and expansion of the area of waterworks management integration (through collective outsourcing by multiple municipalities). These measures basically aim at increasing efficiency in service operations and improving customer services under severe economic conditions.

Under these circumstances, Public Utilities Services Center Co., Ltd. (PUC) was designated in 2006 as an administrative organization under management of the Tokyo metropolitan government. PUC is comprehensively commissioned to run water service operations (at two call centers and several service stations) and develop, maintain, and run the supporting information system (charge collecting system) (as described in Japan Water Works Association Journal No. 899, 2009: 63-93). Under an integrated management structure formed in cooperation with the Bureau of Waterworks, Tokyo Metropolitan Government, we always strive to run the call centers and the service stations efficiently and stably, and maintain and improve the charge collecting system, in order to enhance the performance of thorough water service operations and improve customer services.

In this paper, we describe what an information system that supports water service operations should be to enhance the performance of all service operations and improve customer services, assuming the circumstances described above.

METHODS

Our proposal in this paper is based on PUC's considerable long-term experience and track records in developing, maintaining, and running the charge collecting system as well as our recent experiences on running water service operations.

RESULTS AND DISCUSSION

Before proposing what an information system should be, indicated by the title of this paper "From a Conventional Water Service Operation System to a Widely Integrated System," we briefly describe recent trends in the Japanese waterworks. Then, we review water service operations and discuss the actual status of charge collecting systems. Finally, after explaining the flow and effects of the shift from a conventional water service operation system to a widely integrated system, we describe domestic and global deployment.

Trends in Japanese Waterworks

As of the end of FY 2006, the coverage rate of water supply in Japan reached 97.3%, so almost everyone can use water supply services. Waterworks depend on revenue from payments by water service users, who are mainly concerned about feeling safe and comfortable about the water supplied. Therefore, supplying water safely and stably is the most critical issue for waterworks utilities.

Waterworks Vision. In this background, the Ministry of Health, Labour and Welfare established the "Waterworks Vision" in June 2004 (amended July 2008) (Health Service Bureau, Ministry of Health, Labour and Welfare, 2004). This is a long-term vision to be achieved in the mid-21st century. It comprehensively clarifies policy issues we should concentrate on in the future, specific measures and actions to be taken, schedules, and so on. In October 2005, the same ministry published the *Guidelines for Establishing Regional Waterworks Visions*, in which waterworks utilities are recommended to prepare their own regional waterworks visions. Those visions should show how to cope with five main issues—"Safety," "Stability," "Sustainability," "Environment," and "Globalization"—under the basic principle set forth in the "Waterworks Vision" that "We pursue the challenge of building a water supply system that makes us a leading global player." Those visions should also include future goals for the entire waterworks industry to aim at and address, after waterworks utilities analyze and assess the present conditions and future prospects of their own operations.

Individual waterworks utilities have responded one by one to these actions by the central government by beginning to develop their own regional waterworks visions (Ministry of Health, Labour and Welfare, 2011). For example, the Tokyo metropolitan government established the "Tokyo Waterworks Management Plan" (Bureau of Waterworks, Tokyo Metropolitan Government, 2009, 2010) as its basic policy for business operations.

Service area expansion policy. To promote the important measures stated in the "Waterworks Vision," it is necessary to strengthen the basic infrastructure of waterworks operations in both the aspects of management and technology. As one of the actions to be taken, it is important to promote a new scheme to expand the water service area. The scheme involves the centralization of management, the integration of technical management, and so on, in addition to the conventional scheme for a wide-area water supply system. A practical example of this new scheme is management scope expansion through mutual or shared outsourcing of facility management and maintenance activities according to the natural and social conditions of the local area. Another example is service area expansion for disaster preparedness through the joint monitoring of the quality of raw water, building of a mutual support framework, sharing of reserves of materials, etc.

In August 2008, the Japan Water Works Association (JWWA) published the *Guideline for Considering Expanded Water Supply Services: Promotion of Waterworks Vision* (JWWA, 2008). This guideline suggests procedures to be taken and materials to be considered when waterworks utilities discuss and implement the ways of expansion most suitable to them to promote the new

scheme. The guideline also includes the results of several case studies for reference, compiled from questionnaires and interviews about unifying operations and management, sharing facilities, etc.

The *Guideline for Considering Expanded Water Supply Services* positions water service operations as one of the target areas in which we should consider service area expansion, and recommends establishing joint service stations to unify front-end customer operations, joint development and maintenance of charge collecting systems, etc.

Water Service Operations

We can roughly classify water service operations, which consist of many kinds of work, into three categories; basic operations associated with collecting charges, operations incidental to the basic operations, and operations providing water service users with various kinds of information.

Below, we explain the above three categories of water service operations, referring to the *Water Service Operations Manual* (JWWA, 2005) published by the JWWA and the *Waterworks Handbook* (Bureau of Waterworks, Tokyo Metropolitan Government, 2009) published by the Bureau of Waterworks, Tokyo Metropolitan Government.

Basic service operations associated with collecting charges. The basic service operations associated with collecting charges consist of such work as installing water meters, receiving service start and service stop requests, reading meters, calculating water charges, billing the charges, receiving payments, urging customers in arrears to pay their bills, and so on.

A customer submits an application to start service when the customer wants to start using water after a move or building a new house. A customer submits an application to stop service when the customer wants to stop using water because of a move or the sale of a house. The usual service operations between service start and service stop, to be processed sequentially and cyclically, are as follows: read a water meter to determine the quantity of water used, calculate the water charge based on the measurement of water consumption, bill the user for the calculated charge, and receive payment from the user.

Each of the above service operations can be divided into still smaller operations.

For example, let’s take a closer look at the operations in receiving payments. Typical methods of water charge payment in Japan include payment of the bill at a bank, a convenience store, or a counter of a waterworks utility service station, account transfer payment, and payment by credit card. The subsequent operations vary with the payment method, which is selected by the user.

For another example, let’s look at the determination of the quantity of water used and the calculation of the corresponding charge. These operations involve many exceptions. If an installed water meter is out of order or cannot be read because of certain geographical or physical conditions at the location of the meter, the water consumption during the concerned term must be determined based on the past consumption record or other reasonable grounds. For water service users who live on welfare or have other reasons to be exempt from payment of all or part of water charges, waterworks utilities must accept applications for this exemption and calculate the water charges accordingly.

Collecting overdue water charges is also an important operation basically related to collecting charges, although doing so is not included in the normal operations. Waterworks utilities need to assume water service users may, intentionally or unintentionally, not pay their water charges by the due date. Since waterworks cannot continue unless water service users pay their water charges, and the paying users would justly feel it is unfair to them if other users do not pay water charges properly, an essential task is to collect water charges fairly.

Let’s look at the operations to collect overdue water charges. Any user who does not pay water

charges by the due date is urged to pay by a newly specified due date. If the water charges remain unpaid, the user is urged again to pay and warned that water supply will stop unless payment is made. If the water charges still remain unpaid, the user is urged to pay and gets a notice that water supply will stop on a specified date. If the user does not pay by the water supply stop date, the supply of water stops. After the water supply stops, water supply will resume immediately when payment by the user is confirmed.

Incidental operations. Water service operations incidental to the basic operations associated with collecting charges include accepting and saving written applications and managing the progress of service operations.

An example is the operations to accept water charge exemption applications from water service users. When a water service user goes to a service station and submits a water charge exemption application, the employee in charge accepts the application and writes information about the application in the acceptance book. Next, the employee checks the customer information and registers the water charge exemption in the charge collecting system. The employee updates the acceptance book upon approval by the manager in charge. Thus, the operations to accept an application for water charge exemption are completed. The progress in this workflow is managed with the acceptance book.

The Tokyo Metropolitan Waterworks Bureau has at least 10 types of applications conducted through such a workflow as mentioned above.

Providing information to water service users. The information provided to water service users includes water consumption information and answers to questions. By providing information on actual water consumption to water service users, we can raise their awareness of water usage, possibly leading them to save water and take the environment into consideration. The Internet is a suitable medium for providing this type of information. In addition, appropriate responses to inquiries about water charges, water stoppage, turbid water, water leakage, etc. are important to improving customer satisfaction. Generally, a call center provides a centralized means of handling these inquiries.

Charge Collecting System

Most waterworks utilities in Japan have already introduced conventional water service operation systems, in other words, charge collecting systems, which support the basic service operations associated with collecting charges.

However, the charge collecting systems of the individual waterworks utilities vary in functionality and support coverage. One reason is the Water Supply Act, which specifies that each municipal government stipulate its own ordinances to control the water supply contracts between the waterworks utility and water service users. Consequently, the methods for calculating water charges and various fees vary from one municipal government to another. Another reason is that new services (e.g., credit card payment of water charges) cannot always be provided uniformly by all municipal governments because of the relationship between demand and cost effectiveness at each municipal government.

The charge collecting systems where water service operations are not limited to basic operations associated with collecting charges but include various kinds of work can be called systems for the service operations only in a narrow sense.

From a Conventional Water Service Operation System to a Widely Integrated System

Although charge collecting systems have come into widespread use, there is room left for further improvement. Otherwise, with the existing systems, we will become unable to properly handle water service operations because of institutional changes relating to waterworks, advances in related peripheral technologies, greater diversity of water service users' lifestyles, etc.

We can improve the existing charge collecting system itself and evolve it into a widely integrated system that supports the various kinds of operations incidental to charge collecting procedures, so we can call the integrated system a service operation system in a broad sense.

Improvements on the existing charge collecting system. As typical examples of improving the existing charge collecting system, we show how to improve the efficiency and accuracy of the operations for reading meters and collecting overdue water charges.

Generally, operations to read meters mean a meter reader with a handheld terminal visits a water service user's home, reads the meter, and enters the readings into the handheld terminal. The meter reader is assumed to know the location of the water meter and have access to it. However, the assumption of access to the meter by the meter reader is unreasonable considering that an inexperienced meter reader and physical obstacles (such as lots of snow) blocking access to the meter are possible. One possible solution to the above problem is to enable the handheld terminal to read the meter via received radio signals. Wireless meter reading is expected to improve the accuracy of meter reading and the meter reader's safety. However, there are difficulties concerning the cost and time required to install wireless meters.

Next, let's look at operations to collect overdue water charges, where a bill collector with a non-payment card in hand visits a water service user to urge the user to pay overdue water charges. The non-payment card contains personal information such as non-payment reason and non-payment history, so any leakage of information from the non-payment card will have a significant effect on waterworks and the waterworks utility. In addition, if the user has already paid the charges before the bill collector visits, the visit may give the user a bad impression or lead to more serious trouble in the future. One possible solution to the above problem is to introduce a mobile terminal system so that the bill collector can check real-time payment information with the system when visiting users. Not only can this system prevent the possibility of personal information leakage and trouble with users, it will also improve customer service.

Expanding the range of systematization. We can achieve many improvements by expanding the range of systematization of the operations incidental to the basic operations so that service operations will be done more efficiently and accurately, since the current ways of processing depend on the skills of the individual.

For example, when processing water charge exemption applications, we pass the applications around and manage the progress of the workflow manually. These manual operations involve risks such as application loss or damage and forgotten tasks. As a solution, we can build a computer system with which we manage written applications, and can make it work together with the charge collecting system by introducing a workflow system. This system can greatly increase efficiency and accuracy in reception work starting with the reception of written applications.

Merging call center systems with the charge collecting system. A key site for centralized water service operations is a call center for accepting requests, inquiries, and various other calls from water service users.

The call center requires a call-center-specific system generally referred to as CTI (Computer Telephony Integration). CTI makes it possible to evenly and efficiently distribute calls from many water service users to call center operators, provide automated voice responses to guide water service users, filter requirements in advance, etc. Another essential system for call centers is a call recording system. Used to manage individual messages from water service users, this system is not only necessary for managing customers but also important for maintaining and improving waterworks. This is because the call record database holds water service users' raw opinions, which can be analyzed to identify potential customer needs and business operations that need improvement. If used appropriately, the call record database is a treasury of useful information.

Next, let's look at operations to provide information. If a Q&A system used in the call center internally is made available to customers, such as via the Internet, we can handle inquiries more efficiently and provide better service to water service users. Additionally, operations to accept applications in the call center are finally completed when registered in the charge collecting system. Meanwhile, even just for a response to an inquiry, the call center operator needs to refer to the charge collecting system.

This means the call center systems and the charge collecting system should be combined organically. Otherwise, water service users may feel inconvenienced by delayed responses, and call center operators' work efficiency may be adversely affected.

Toward the widely integrated system for service operations. For the reasons stated above, we believe we should evolve the conventional water service operation system into the widely integrated system for service operations.

The first step is improvement of the existing charge collecting system. The next step is expansion of the range of systematization so that the system can support operations incidental to the basic operations associated with collecting charges. The system will also work together with other systems such as the call center systems organically. The final step is the evolution of the new charge collecting system into the widely integrated system for service operations that can support all the work involved in water service operations.

A key point to the evolution process of this service operation system is to promote systematization under one unified concept while respecting that the ideal system is the widely integrated system for service operations itself. The one unified concept mentioned above means a policy for installing an integration infrastructure that combines multiple subsystems organically and unifying methods of operation across systems (Kuwada & Yamauchi, 2008).

Rebuilding as an integrated system. It seems that a conventional water service operation system contains a charge collecting system as its basis and subsystems and/or supplementary functions added to meet customer needs or implement the waterworks utility's policies. As is often the case, the system is not an optimum system from the viewpoints of cost and efficiency. To solve this problem, we should rebuild the conventional system into an integrated system.

Effects of the Widely Integrated System for Service Operations

We can expect various effects by evolving a charge collecting system into a widely integrated system for service operations. This section gives an overview of the principal effects and then discusses effects on service area expansion and comprehensive outsourcing in detail.

Principal effects.

No.	Principal effect	Outline
(1)	Consistent work processes	Consistent services can be provided through unified methods of performing work that used to be done in varying ways depending on the waterworks utility or, even within one utility, on personal skills.
(2)	Increased work process efficiency	Work process efficiency can increase because the coverage of system support has expanded to the extent that there is less manual work and fewer problems due to poor linkage with other systems.
(3)	Reduced education investment	One unified concept leads to unified work processes, so a reduction in investment in related training can be expected.
(4)	Improved level of customer service	Expanded coverage of system support makes it possible to improve customer service and to meet the diversity of customers' lifestyles.
(5)	Reduced systematization investment	One unified concept leads to reduced systematization investment, while linkage among multiple systems designed based on different concepts requires much cost and work for data conversion, etc.

Effects on service area expansion. We think there are two methods through service area expansion for unifying service operations of multiple waterworks utilities with different processing methods and scopes of service. The first method is to unify only customer reception tasks while leaving unchanged the processing methods and scopes of service of each waterworks utility. The second method is to unify not only customer reception tasks but also the different processing methods and scopes of service.

Although the second method involves difficulty in unification, it is more suitable for service area expansion, considering future possibilities, work process efficiency, and consistent customer service. The first method increases costs for systematization investment and training of staff engaged in customer reception tasks. It also causes uneven levels of service to water service users.

The widely integrated system for service operations strongly supports service area expansion in the second method. This is because the widely integrated system for service operations is built based on one unified concept and its scope of support fully covers water service operations.

Effects on comprehensive outsourcing. A widely integrated system for service operations is also effective for comprehensive outsourcing of water service operations and their support systems. The outsourcing party can receive higher-quality services at lower cost, and the subcontractor can provide consistent services efficiently.

The implementation of a widely integrated system for service operations not only allows the waterworks utility and the outsourcer to enter a win-win relationship but also increases customer service levels because water service operations are upgraded overall. Moreover, a win-win-win relationship can be built among the three parties.

Deployment Inside and Outside Japan

We discuss deployment of a widely integrated service operation system inside and outside Japan.

Deployment inside Japan. In Japan, water service coverage reached 97.3% at the end of FY 2006, which means most people can use water services, and they take it for granted they need to pay for the supplied water (Inose, 2010). In this country, therefore, a widely integrated system for service operations or its concept can be implemented at any waterworks utility.

However, we don’t think small-scale waterworks utilities can receive benefits from the system deployment for reasons relating to cost effectiveness if they install the system on their own. Small-scale waterworks utilities seem to have the best chance of deploying the system when they unify their business operations by means of service area expansion.

Deployment outside Japan. A widely integrated system for service operations shows its best performance in conditions where advanced high-level water facilities are already installed and water service users are not reluctant to pay for supplied water. Every waterworks utility outside Japan is assumed to want what their counterparts in Japan are seeking, even though waterworks coverage and water service users’ attitudes toward payment of water service charges vary from one country or region to another.

Even in waterworks in countries and regions where the conditions differ from those in Japan, we believe waterworks utilities can improve work process efficiency and provide more meticulous customer service by employing the concepts underlying the widely integrated system for service operations, which is an aggregation of best practices. The system can thus contribute to the growth of waterworks in the countries and regions where it is deployed.

CONCLUSIONS

The United Nations adopted the Millennium Declaration at the Millennium Summit held in September 2000 (United Nations, 2000). This declaration contains “UN Millennium Development Goals,” which include a specific goal: “Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.” Since then, various countries in the world have started a variety of related activities. The First Asia-Pacific Water Summit (Asia-Pacific Water Forum, 2009) was held in December 2007. Goals more specific than the UN millennium development goals were set at this summit. Activities to implement effective measures for these goals are in progress.

As we look around the world, we can find that the conditions for a stable supply of safe water vary from one country or region to another, but one common condition is that water service operations must be performed properly for the development and continued stability of waterworks. In this way, the widely integrated system for service operations can contribute to the maintenance and development of waterworks not only inside but also outside Japan. We would be pleased if this paper helps in the development of waterworks globally.

REFERENCES

Asia-Pacific Water Forum (2009) *Final Report of the 1st Asia-Pacific Water Summit (Water Security: Leadership and Commitment)* (in Japanese). Available at: http://www.waterforum.jp/jpn/summit/doc/final.pdf (accessed 15 May 2011).

Bureau of Waterworks, Tokyo Metropolitan Government (2009) *Waterworks Handbook* (in Japanese). Bureau of Waterworks, Tokyo Metropolitan Government.

Bureau of Waterworks, Tokyo Metropolitan Government (2009) *Water Supply in Tokyo: Provision of Excellent Water and High-Quality Services*. Bureau of Waterworks, Tokyo Metropolitan Government.

Bureau of Waterworks, Tokyo Metropolitan Government (2010) *Tokyo Waterworks Management Plan 2010.* Available at: http://www.waterworks.metro.tokyo.jp/eng/plan/index.html (accessed 15 May 2011).

Health Service Bureau, Ministry of Health, Labor and Welfare (2004) *Waterworks Vision.* Available at: http://www.mhlw.go.jp/english/policy/health/water_supply/3-1.html (accessed 15 May 2011).

Inose N. (2010) *Becoming Vice Governor of Tokyo* (in Japanese). Tokyo: Shogakukan.

JWWA (2005) *Water Service Operations Manual* (in Japanese). Japan Water Works Association.

JWWA (2008) *Guideline for Considering Expanded Water Supply Services: Promotion of Waterworks Vision* (in Japanese). Available at: http://www.mhlw.go.jp/topics/bukyoku/kenkou/suido/kouikika/index.html (accessed 15 May 2011).

JWWA (2009) *Prospect of Expanded Water Supply Services in Shorthand Records from the Forum of the 60th National Waterworks Conference* (in Japanese). Japan Water Works Association Journal No. 899: 63-93.

Kuwada H. and Yamauchi Y. (2008) *Need and Future Challenges in Installing an Integrated Business Processing Infrastructure on a Client PC* (in Japanese). Collection of Lectures Delivered at the 59th National Waterworks Conference, p. 40-41.

Ministry of Health, Labor and Welfare (2011) *Status of Regional Waterworks Vision Plans* (in Japanese). Available at: http://www.mhlw.go.jp/topics/bukyoku/kenkou/suido/topics/chiiki.html (accessed 15 May 2011).

United Nations (2000) *Millenium Development Goals*. Available at: http://www.unmillenniumproject.org/ (accessed 15 May 2011).